DIORYCTRIA DAMAGE IN SLASH PINE SEED ORCHARDS

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Abstract.--Cones from 4 International Paper Company (IPCo) slash pine seed orchards were examined for Dioryctria spp. damage as they were processed at the seed extractory. Dioryctria damaged cones ranged from 22% to 49% among the 4 orchards. Comparisons indicate that orchards established in agricultural areas had significantly less Dioryctria damage than orchards established amid cone-producing pine stands.

Additional keywords: Pinus elliottii Engelm cone insects, natural control, insect populations, Guthio spray program.

Cones of slash pine, Pinus elliottii Engelm., are frequently attacked or destroyed by insects. The most common cone-infesting insects are larvae of Dioryctria spp. To assess the amount of insect damage, the mature cone crop can be examined at harvest (Merkel and DeBarr 1971; DeBarr, et al 1972; and DeBarr 1974). The figures obtained, however, can only be considered as relative estimates since previous studies have shown that harvest tallies underestimate the total impact of Dioryctria on second-year cone crops (DeBarr 1974). This study was designed to estimate the amount of Dioryctria damage to cones harvested in 1976 from 4 IPCo slash pine seed orchards.

METHODS

Cones were analyzed from 4 slash pine seed orchards in 2 geographic areas. Two orchards are located in southern Alabama: Gateswood Seed Orchard (6.9 ha) in Baldwin Co., and Jack Springs Seed Orchard (6.1 ha) in Escambia Co. Two others, Dellwood Seed Orchard (12.1 ha) and Bellamy Seed Orchard (10.5 ha) are located in Jackson Co., Florida. The Jack Springs and Bellamy orchards were established in the middle of agricultural fields. The Gateswood and Dellwood orchards, however, were established amid cone-producing pine stands. Gateswood, Dellwood, and Jack Springs contain trees averaging 14-16 years old, and trees at Bellamy average approximately 8 years old.

Initially, a 100% cone tally was made as cones were processed at the Southlands Experiment Forest's seed extractory. Based on the distribution from the 100% tally, a sample size was chosen so that the proportion of damaged cones could be determined (±5%) at a 95% confidence level. Cones were randomly selected from every bushel in each lot. The number of sample cones per bushel was dependent on the total number of bushels in each lot. In each orchard,

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cones from clones resistant to fusiform rust, Cronartium fusiforme Hedgc. and Hunt ex Cumm., were collected separately from fusiform rust susceptible clones. These two lots were analyzed separately.

Each sample cone was placed in one of the following damage classes according to the amount of Dioryctria damage: Class 0 - no damage; Class 1 - one Dioryctria boring hole; Class 2 - two Dioryctria boring holes; Class 3 - three or four Dioryctria boring holes; and Class 4 - a totally damaged cone. The percent of damaged cones by class was then determined for each orchard. Comparisons were made among orchards for damage classes 1 through 4 and the total amount of Dioryctria damage per orchard.

RESULTS AND DISCUSSION

Dioryctria damaged from 22% to 49% of the 1976 slash pine cone crop (Table 1). No significant differences were found in Dioryctria damage between fusiform rust resistant and fusiform rust susceptible lots; therefore, they were grouped together by orchard for final analysis. All orchards had more damaged cones in Class 1 than in the other three classes. Damage Class 4 exceeded Classes 2 and 3, in all orchards. This was expected since Class 4 cones often sustained additional damage from factors other than Dioryctria. Sartor and Neel (1971) reported that seed yields from Dioryctria-infested cones are almost nil and are considered a total loss. Observations in this study indicated that Class 1 cones partially open and yield some seed, whereas Classes 2,3, and 4, seldom, if ever, open. The percentage of cones in Classes 2, 3, and 4, therefore, reflect complete seed loss. The total amount of insect damage differed among orchards. Jack Springs and Bellamy had significantly lower infestation levels than Gateswood and Dellwood.

In the early 1970's with the initiation of a Guthion® spray program in both Gateswood and Dellwood seed orchards, a reduction in the amount of Dioryctria damage was observed (Merkel, et al 1976). In an attempt to explain the current high levels of Dioryctria damage and the differences among orchards, each orchard's cone harvests and insecticide spray programs for 1975 and 1976 were examined. In 1976 Gateswood produced approximately 47.9 hl of cones per ha and Jack Springs produced approximately 30.3 hl of cones per ha. Cone production levels in these 2 orchards did not differ significantly during 1975 and 1976. Both orchards were sprayed, by the same crew, with a mist blower times each year (April, May, June, July, August, and October). A 1% Guthion® solution was applied to opposite sides of each ramet at the rate of 3.8 l of spray per ramet. The difference in insect control between these 2 orchards most likely reflects variation in the abundance of insects in each area. Jack Springs was established in an area surrounded by fields while Gateswood was established within a 50-year-old longleaf pine stand.

Dellwood and Bellamy were sprayed, by a second crew, with a mist blower 6 times each year. A 1% Guthion® solution was applied in the same months and at the same rates as above. Dellwood's slash pine crop was lower in 1976 than in 1975 (35.94 hl of cones per ha and 43.34 hl of cones per ha respectively). Generally, insert damage is believed more abundant when a small cone crop follows

Table 1. Dioryctria spp. damage to the 1976 slash pine cone crop in 4 IPCo seed orchards.

Orchard	Damage Classes 1	2	3	4	Total Damage
Dellwood	19.9[1/] [2/]	9.8	7.8	11.1	48.5
Gateswood	19.4	9.6	5.5	9.7	44.2
Jack Springs	14.0	5.1	3.5	7.9	30.5
Bellamy	14.8	1.2	0.0	5.8	21.9

1/ Percents

2/Numbers joined by ars are not significantly different at the 95% confidence level.

a bumper crop. Dellwood's drop in production by itself would not account for the high percentage of insect damage. Bellamy's cone crop has been increasing since 1971 with 27.1 hl of cones produced in 1976. Established in an old agricultural area, Bellamy is still surrounded primarily by agricultural fields and a few mixed hardwood stands. The closest pine stands, located approximately 91 m away from one corner of the orchard, are not yet producing cones. Thus, when Bellamy came into production, a large Dioryctria population probably was not present in the area. Additionally, in Bellamy, a delayed-density dependent relationship is probably operating (DeBarr and Barber 1975). A smaller infestation rate would, therefore, be expected until the cone production levels off and the insect population catches up. Dellwood, until 1976, was surrounded by mature pine stands. A 91 to 122 m buffer area was cleared around the orchard between 1973 and 1976. The adjacent pine stands still would have influenced Dioryctria levels in the orchard, however. Once again insect abundance appears to be partially related to the areas surrounding the orchards.

SUMMARY AND CONCLUSIONS

Dioryctria damage levels were quite high in the 4 seed orchard cone crops examined. These damage levels suggest: (1) Guthion® was ineffective in preventing Dioryctria damage, and the need exists to investigate the application and timing of the individual orchard spray programs; (2) the possibility of Dioryctria resistance to Guthion® the orchards as a result of these multiple, annual sprays; and (3) orchards established in agricultural areas have less Dioryctria damage than those established in pine stands. Studies are needed to assess the relative seasonal abundance and migration behavior of insects in order to select low risk sites for the location of future seed orchard complexes. However, these preliminary observations suggest that seed orchards established in agricultural areas may remain relatively free from Dioryctria damage and that cone bearing pine stands near orchard sites should be removed as early as possible to minimize insect abundance by the time the orchards reach cone bearing age.

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